Space Weather Technical Forecast

Issued on Wednesday, 28 September 2022 at 01:13 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G1-G2/Minor-Moderate geomagnetic storms likely to develop from late day 3 (30 Sept). Chance of R1/Minor Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with several C-class flares observed, mostly from AR3107 and AR3105. The peak flare was a C5.1 at 27/1957 UTC from AR3105. This is one of four numbered active regions and one un-numbered region on the visible disc. Three regions are of moderate longitudinal extent. AR3110 in the northeast quadrant, is a relatively simple bipolar region with some slight decay in its trailer portion. AR3107 in the southwest quadrant, is the longest region and has shown some coalescence in its lead/intermediate spot portion, with a small delta spot evident. Conversely the trailing spots have shown decay. AR3105, also in the southwest, has shown a few new small intermediate spots emerge. AR3108 has almost faded now. The new un-numbered region near the northeast limb appears to be a single Hsx/Alpha type.

No Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar wind parameters have indicated a combination of HSS (CH26/-) and CME influences, with the latter appearing to have now waned.

The solar wind speed, as measured by DSCOVR at L1, rose from 360km/s to around 600km/s during the second half of the UTC day. The density started well above average, with a maximum of 92ppcc at 27/0051 UTC, before gradually falling back to around average levels towards midday UTC. The total Interplanetary magnetic field strength, Bt, became briefly Very Strong with a peak value of 31 nT at 27/0429 UTC, then gradually declined back to weak levels. The north-south component, Bz, followed a similar trend but stayed mostly positive during much of the Strong and Very Strong periods, with fluctuations between +30/-17nT. The phi angle was initially positive (away from the sun), but soon switched to negative (towards the sun). Geomagnetic activity was at G1/Minor Storm level for the initial 27/0000-0300UTC interval, then Quiet to Active (Kp 2 to 4) thereafter.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16, remained very slightly raised above normal background levels, but well below S1 levels. High energy electron flux (greater than 2 MeV) was predominantly at background levels, with a brief peak reaching 215 pfu at 27/1705 UTC. The associated 24-hour fluence remained below the Active (1e8 integrated pfu) threshold, with a sharp drop through the day from an initial reading of 7.67e7 integrated pfu at 27/0000UTC. Observed fluence at 28/0000UTC was 1.19e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be generally Low, with a chance of isolated M-class flares, primarily from AR3107 and AR3105.

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Solar Wind / Geomagnetic Activity: Elevated solar winds speeds are expected to reduce back to slightly elevated levels by day 2 (29th) due to waning HSS effects. The HSS from CH27/+ is then expected to arrive from late day 3 (30th) or perhaps day 4 (1st Oct), and continue through the weekend UTC, with strong solar winds likely to develop.

Geomagnetic activity is likely to be mostly Quiet to Unsettled, but with isolated Active intervals still possible in the first half of day 1 (28th). From the second half of day 3 (30th) onward, G1/Minor storm intervals are likely to develop, with a chance of G2/Moderate storms, and a slight chance of isolated G3/Strong storms.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to persist at background levels, with a slight chance of reaching S1 (or greater), most likely from AR3107 and AR3105. The high energy (greater than 2MeV) electron flux will likely remain at mostly background initially, perhaps rising to moderate or high levels later in the period. The associated 24 hour fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but with an upward trend probable toward the end of the period.

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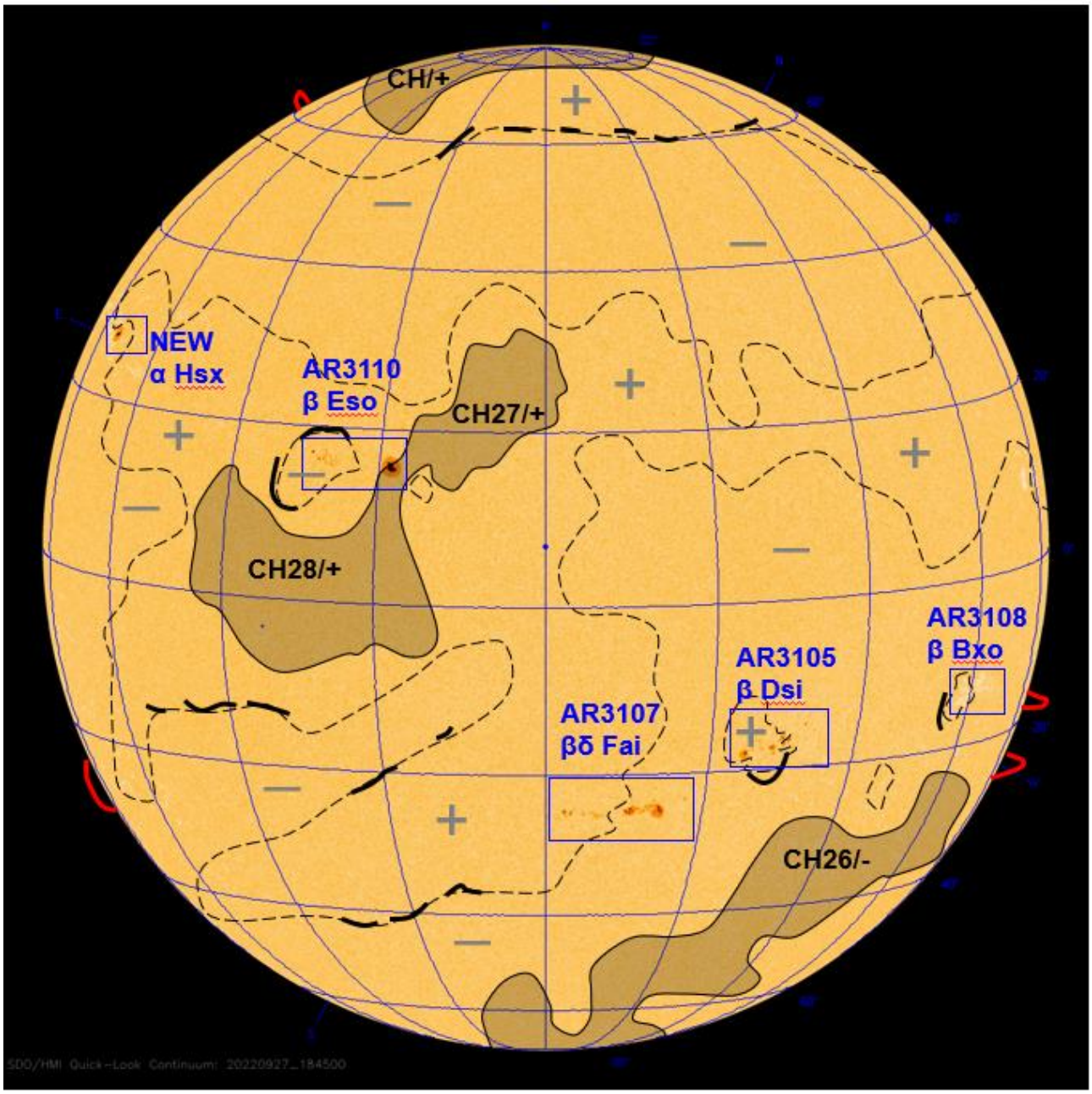
Figure 1. Solar Analysis Valid 27/1900UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

Solar wind speeds are currently elevated due to ongoing coronal hole influence from CH26/-. Earlier transient CME effects have now waned. Solar winds speeds are expected to reduce back to slightly elevated levels by day 2 (29th) due to waning HSS effects.

The HSS from CH27/+ is then expected to arrive from late day 3 (30th) or perhaps day 4 (1st Oct), and continue through the weekend UTC. Last rotation this CH gave strong solar wind speeds above 700 km/s, and a brief G3/Strong storm interval near the onset. A similar forecast for this rotation seems reasonable, with present imagery comparing favourably with 27 days ago.

Geomagnetic activity is likely to be mostly Quiet to Unsettled, but with isolated Active intervals still possible in the first half of day 1 (28th). From the second half of day 3 (30th) onward, G1/Minor storm intervals are likely to develop, with a chance of G2/Moderate storms, and a slight chance of isolated G3/Strong storms.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	20	5	60	70
Strong	G3	No	1	1	10	10
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None currently expected.

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Figure 2: Plot of observed solar wind parameters from DSCOVR satellite, courtesy of NOAA/SWPC. (Note suspect data for bottom three measures between 1630 and 2030 UTC)

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Radio Blackouts - X-Ray Flares:

Solar activity has been Low with occasional C-class flares, mainly from AR3107 and AR3105. Generally Low levels of activity are forecast to continue, but with a chance of isolated M-class flares, most likely from the spot groups already mentioned.

There are currently four numbered active regions and one un-numbered region on the visible disc. Three regions are of moderate longitudinal extent. AR3110 in the northeast quadrant, is a relatively simple bipolar region with some slight decay in its trailer portion. AR3107 in the southwest quadrant, is the longest region and has shown some coalescence in its lead/intermediate spot portion, with a small delta spot evident. Conversely the trailing spots have shown decay. AR3105, also in the southwest, has shown a few new small intermediate spots emerge. AR3108 has almost faded now. The new un-numbered region near the northeast limb appears to be a single Hsx/Alpha type.

There are also two potential returning regions that are due to reach the east limb during the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) as observed by GOES16 has been at background levels, although very slightly elevated. Background levels are expected to continue, with a slight chance of S1 (or greater) radiation storms, mainly from the presence of AR3105 and AR3107 in the southwest quadrant.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2MeV) electron flux, as observed by GOES-16 has been largely at background levels following the increased geomagnetic activity associated with HSS and CME influences, which have allowed electron populations in the Van Allen belts to be re-distributed. The next significant rise is anticipated to be once the HSS from CH27/+ becomes established near the end of the period.

The associated electron 24 hour fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, but with a likely rising toward the end of the period. REFM is currently considered to be giving poor short term trend guidance, though longer term trends are considered more likely, these probably staying below Active fluence.

GEO Electron Environment	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^{8}$	No	1	10	20	30
Very Active	≥ 2 MeV ≥ $1x10^{9}$	No	1	1	1	1

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